JOURNAL

OF THE

AMERICAN CHEMICAL SOCIETY.

VOL. XII.—NO. 3.

MARCH,

1890.

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PUBLISHED MONTHLY.

NEW YORK:
JOHN POLHEMUS,
102 Nassau Street.
1890.

The **Journal of the American Chemical Society** appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

The Price of Subscription is $5.00 per year, in advance.

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WILLIAM RUPP, 117 Pearl St., New York.

The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, MARCH 7th, 1890.

Vice-President Breneman in the chair.

The minutes of the February meeting were read and adopted; also the minutes of the Directors' meeting held March 6th.

George Stiff, Long Island City, N. Y., and Francis J. Oakes, 85 Stone street, New York, were unanimously elected as Associate Members.

The following papers were read: "On the Determination of the Firing Points of Various Explosives," by Prof. C. E. Munroe (read by the secretary); "The Action of Nitrous Anhydride on Organic Bodies," by L. H. Friedburg and J. A. Mandel; "Hydrogen Dioxide, its Manufacture and Applications," by A. Bourgougnon.

The resignations of Dr. Koenig and Dr. Adler were read and accepted. The editor reported from the Committee on Papers and Publications that the JOURNAL was now up to date.

The meeting was then adjourned.

CHAS. F. McKENNA,
Recording Secretary.

ON THE ACTION OF NITROUS ANHYDRIDE UPON ORGANIC COMPOUNDS.

By L. H. Friedburg and John A. Mandel.

(*Second Paper.*)

Before taking up the study of the reaction of nitrous anhydride upon benzaldehyde, we submitted diphenyl and benzonitrile to the same reaction under the conditions already given.

Diphenyl and Nitrous Anhydride.—Diphenyl was prepared by the method of Berthelot,[2] as modified by G. Schultz[3] and by H. Hübner.[4] A piece of ¾-inch gas pipe about two feet long was filled with pieces of pumice of about half the size of a pea and heated in an ordinary combustion furnace so that a length of four decimetres in the middle of the pipe were kept at a bright red heat. One of its ends was tightly connected with a flask in which benzol was kept gently boiling on a water bath. A current of carbon dioxide was allowed to pass through the benzol and with the vapor through the heated pipe. The other end of the pipe was connected with two well cooled flasks. In these the gases were condensed. The second flask carried in addition a piece of glass tube to lead away uncondensed gases into the chimney. After all of the benzol had passed through the hot iron tube, the liquid from the flasks was returned to the flask from which the benzol had been distilled and two-thirds of it were again vaporized

[1] J. Am. Chem. Soc., **12**, *7*.
[2] Comptes rendus, **63**, *788, et seq.*
[3] Ann. Chem. (Liebig), **174**, *201*, and Ber. chem. Ges., **7**, *52*.
[4] Ann. Chem. (Liebig), **209**, *333*.

through the hot pipe. This last distillation was repeated once more. The liquids collected, containing diphenyl and unchanged benzol were united and the benzol driven off on a water bath. The residue was put into a flask with hot water, boiled, and the diphenyl distilled with steam. A good Liebig's condenser served for condensing the compound which was collected on a filter, pressed, dried and crystallized once from alcohol. Thus diphenyl was easily and abundantly obtained chemically pure and in flat, shining crystals of a snowy white.

Diphenyl, dissolved in carbon disulphide, was then treated (in the manner described in our first paper) with nitrous anhydride. The brown vapors having totally disappeared, the carbon disulphide was driven off on a water bath and the residue distilled in a current of steam, to separate the products formed from unattacked diphenyl which was condensed and regained in the cooler. The residue in the distilling flask contained an oily substance, heavier than water and but slightly soluble in it. The faintly yellow colored, watery solution was poured off and the oily mass solidified slowly. It was dissolved in alcohol.

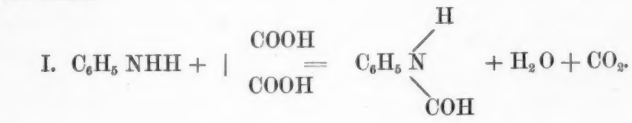
A crop of brown crystals was obtained the following day. These were redissolved in alcohol and soon deposited in long, colorless, brilliant needles which proved to be paramononitrodiphenyl of the exact melting point 113° C. The mother liquor was allowed to crystallize and deposited warty crystals, almost brick red, which as yet were not pure enough to identify. As far as our observations go, they do *not* seem to be the isomononitrodiphenyl of melting point 37° C.

Benzonitrile and Nitrous Anhydride.—The preparation of benzonitrile was made a special study. The methods which lead to it, are of but little practical value, except that of Krüss.[5] Our original intention was to follow the prescription of A. W. Hofmann,[6] to treat aniline with perfectly anhydrous oxalic acid. Previous experience had given us some benzonitrile in this manner, but we were astonished in this case (although working most carefully and using varied proportions) to obtain no benzonitrile *at all*, but an

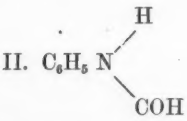
[5] Ber. chem. Ges. **17**, *1767*.

[6] Comptes rendus, **64**, *387*; Ann. Chem. (Liebig) **142**, *125*.

abundance of phenylcarbylamine (isobenzonitrile) of offensive odor. The chemical equations for this reaction speak more simply for the result.



$$\text{I. } C_6H_5NHH + \left|\begin{matrix}COOH\\COOH\end{matrix}\right. = C_6H_5\overset{H}{\underset{COH}{\diagdown\diagup N}} + H_2O + CO_2.$$



$$\text{II. } C_6H_5\overset{H}{\underset{COH}{\diagdown\diagup N}} = C_6H_5NC + H_2O.$$

We, therefore, resorted to Krüss' method (*loc. cit.*), which consists in heating to 190° C. two mols. of benzoïc acid with one mol. of lead sulphocyanide, well mixed in a large retort, to which a Liebig condenser is attached. Amongst other products, formed simultaneously, benzonitrile distills over, rather impure from presence of sulphur compounds. It is quite difficult to remove these latter by fractional distillation alone, but we easily obtained a product entirely free from sulphur, and boiling constantly at + 190° C., by shaking the impure oil vigorously for some time with pure metallic mercury. Benzonitrile thus prepared was used by us, and, as we shall have to repeat the reaction, will be used in future, so that the above description of its preparation will serve as a reference. The experiment did not lead to any notable reaction and we intend to repeat it, but with the difference of working in pressure tubes at high temperatures. The same will be done with diphenyl and nitrous anhydride.

Benzaldehyde and Nitrous Anhydride.—The product of reaction was *not* a substitution product, but the aldehyde was simply oxidized to benzoïc acid. We shall consequently repeat this experiment also in sealed tubes at higher temperatures.

Aromatic Acids and Nitrous Anhydride.—Benzoïc and phthalic acids were used. Neither of these are soluble enough in carbon disulphide to permit of an adequate reaction. A mere trifle was acted upon in both cases. The experiment was repeated, using alcohol as a solvent for the acids. The reaction was better, but

too much nitrous ether was formed and, in the case of benzoïc acid, benzoïc ether in addition. Substitution products formed in these reactions.

The benzoïc acid, treated with carbon disulphide and nitrous anhydride, *without* using alcohol as a solvent, furnished a *nitroso* compound, the barium salt of which was prepared after we had carefully driven off the unattacked benzoïc acid by persistent boiling, continued for nearly a week, replacing the water at intervals. The acid, separated from its barium salt by means of sulphuric acid, melted at 114° C. The barium salt is very sparingly soluble in alcohol, but easily in water, yielding an amber-yellow solution from which the salt crystallized in a few days. A barium determination, using 0.1949 grm. of the crystals, was made, and 0.0953 grm. barium sulphate were obtained. Theory demands 28.98 per cent. Ba for barium *nitroso*benzoate of the formula

$$(C_6H_4.NO.COO)_2.Ba + 2H_2O.$$

We found, according to the figures given: 28.73 per cent.

We have thus found a direct way of preparing nitroso acids, at least nitrosobenzoïc acid, which we shall now try to obtain in larger quantities, using sealed tubes, if possible, for the reaction.

The alcoholic solution of phthalic acid, when acted upon by nitrous anhydride, furnished a yellow oil which solidified after several weeks. It could not yet be used for any determination.

COLLEGE OF THE CITY OF NEW YORK,
March 7, 1890.

DETERMINATIONS OF THE FIRING POINTS OF VARIOUS EXPLOSIVES.

BY CHARLES E. MUNROE.

For this purpose an apparatus devised by Mr. Horsley,* was used which consisted of an iron stand with a ring support holding a hemispherical iron vessel in which paraffine or tin was put.

**Trans. Soc. Eng. (Eng.) 1872, page 15.*

Above this was another movable support from which a thermometer was suspended and so adjusted that its bulb was immersed in molten material in the iron vessel. A thin copper cartridge case, $\frac{5}{8}$ inch in diameter and $1\frac{5}{16}$ inches long, was suspended over the bath by means of a triangle so that the end of the case was one inch below the surface of the liquid. On beginning the experiment the material in the bath was heated to just above the melting point, the thermometer was inserted in it and a minute quantity of the explosive was placed in the bottom of the cartridge case. The temperature marked by the thermometer was noted as the *initial temperature*, the cartridge case containing the explosive was inserted in the bath and the temperature quickly raised until the explosive flashed off or exploded, when the temperature marked by the thermometer was again noted as the *firing point*. The following tables contain the results thus obtained :

GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
65° C.	192° C.	129° C.	200° C.
65° "	201° "	148° "	200° "
80° "	198° "	156° "	199° "
90° "	186° "	158° "	199° "
125° "	199° "		

This was freshly made, compressed military gun-cotton and it was made with standard acids, viz., a mixture of three parts of H_2SO_4 Sp. gr. 1.845, and one part of HNO_3 Sp. gr. 1.5. One centigrm. of the material was used in each of the gun-cotton experiments.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
100° C.	182° C.	170° C.	186° C.
115° "	179° "	170° "	187° "
170° "	185° "	170° "	183° "

This was gun-cotton similar to the above and made in the same way but it had been stored and transported in the wet state for about four years.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
100° C.	187.5° C.	180° C.	187° C.
160° "	186.5° "	180° "	188° "
170° "	187° "	180° "	187° "
170° "	189° "		

This was from the same source as the last but had been in the air-dried condition for probably more than one year.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
117° C.	137° C.	127° C.	139° C.
118° "	139° "	128° "	137° "
125° "	139° "	128° "	139° "

This was a freshly made, long staple military gun-cotton which had been washed as completely as possible without pulping. The acids, however, were not standard.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
80° C.	157° C.	115° C.	154° C.
90° "	154° "	130° "	155° "
100° "	154° "	140° "	158° "
110° "	156° "	150° "	161° "

This was a recently made, compressed military gun-cotton which had been made with the same acid as the last mentioned.

DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
80° C.	136° C.	109° C.	138° C.
105° "	142° "	119° "	141° "
108° "	137° "	123° "	136° "

This pulped military gun-cotton had been previously subjected to a temperature of 65.5° C. for some twenty minutes and then cooled. It had acquired a slight acid reaction.

AIR-DRIED COLLODION GUN-COTTON—LONG STAPLE, SEA ISLAND.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
121° C.	186° C.	154° C.	187° C.
123° "	191° "	159° "	186° "
125° "	189° "		

This gun-cotton was about three years old and had been stored in the dry state in a closed vessel.

AIR-DRIED COLLODION GUN-COTTON—PULPED.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
125° C.	197° C.	182° C.	198° C.
127° "	199° "	183° "	199° "
175° "	197° "	191° "	199° "

This was also about three years old, but had been stored wet.

AIR-DRIED COLLODION GUN-COTTON—LONG STAPLE.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
82° C.	193° C.	168° C.	193° C.
163° "	194° "	174° "	190° "
165° "	195° "	176° "	195° "

This was a commercial photographic gun cotton known as "Helion" which had been stored in the dry state in a paper box, with a loose cover, for more than three years.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
120° C.	196° C.	168° C.	194° C.
167° "	197° "	169° "	192° "
167° "	194° "	171° "	194° "

This was the residue from freshly made military gun-cotton after treatment with ether-alcohol to extract all the "soluble" gun-cotton.

AIR-DRIED GUN-COTTON.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
127° C.	197° C.	184° C.	198° C.
171° "	197° "	185° "	194° "
184° "	198° "	188° "	199° "

This was obtained in the same way but from a sample of gun-cotton which had been stored some four years in the wet state.

HYDRO-NITRO-CELLULOSE.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
169° C.	201° C.	195° C.	211° C.
180° "	203° "	195° "	209° "
190° "	205° "	200° "	213° "
195° "	209° "		

This was about four years old. Had been pulped and compressed and stored in the moist state.

NITRO-GLYCERINE.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
150° C.	204° C.	190° C.	205° C.
180° "	203° "	190° "	205° "
185° "	204° "	195° "	205° "

This nitro-glycerine was some five years old. A single drop was taken for each experiment.

KIESELGUHR DYNAMITE, NO. 1.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
96° C.	197° C.	185° C.	198° C.
180° "	198° "	190° "	199° "
185° "	198° "	190° "	200° "

This dynamite was some eight years old.

EXPLOSIVE GELATINE.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
198° C.	205° C.	192° C.	203° C.
190° "	206° "	195° "	205° "
191° "	204° "	197° "	206° "
192° "	203° "	200° "	209° "

This explosive gelatine was freshly made.

EXPLOSIVE GELATINE, CAMPHORATED.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
90° C.	176° C.	140° C.	174° C.
100° "	176° "	150° "	178° "
110° "	176° "	160° "	177° "
120° "	174° "	170° "	177° "
130° "	177° "	175° "	182° "

This explosive gelatine was two years old.

MERCURY FULMINATE.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
130° C.	177° C.	160° C.	179° C.
140° "	177° "	167° "	175° "
155° "	179° "	170° "	181° "

This fulminate was recently made. It was wholly free from metallic mercury and was in microscopic crystals of very uniform size. The crystals were beautifully twinned and reticulated and belonged apparently to the orthorhombic system.

GUNPOWDER—SHELL.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
242° C.	278° C.	263° C.	279° C.
250° "	280° "	264° "	282° "
258° "	281° "	266° "	279° "
261° "	287° "		

HILL'S PICRIC POWDER—SHELL.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
262° C.	282° C.	271° C.	275° C.
269° "	276° "	271° "	283° "
269° "	273° "	273° "	278° "
270° "	279° "		

HILL'S PICRIC POWDER—MUSKET.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
238° C.	282° C.	269° C.	273° C.
239° "	290° "	275° "	285° "
240° "	285° "	280° "	288° "
244° "	289° "		

These powders had been in store about ten years and they were composed of :

Ammonium picrate	42.18
Potassium nitrate	53.79
Charcoal (best alder)	3.85

FORCITE NO. 1.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
60° C.	187° C.	130° C.	185° C.
80° "	184° "	145° "	190° "
90° "	185° "	170° "	188° "
100° "	190° "	180° "	190° "
110° "	191° "	190° "	200° "

ATLAS POWDER, 75%.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
50° C.	175° C.	140° C.	184° C.
80° "	178° "	150° "	184° "
100° "	176° "	160° "	184° "
120° "	176° "	170° "	183° "
130° "	184° "	175° "	185° "

EMMENSITE NO. 1.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
60° C.	178° C.	120° C.	170° C.
70° "	184° "	135° "	174° "
80° "	167° "	145° "	173° "
90° "	170° "	150° "	170° "
100° "	180° "	160° "	178° "

This emmensite had been stored in the magazine for some months in the original package (wooden box) in which it had been received.

EMMENSITE NO. 2.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
60° C.	177° C.	130° C.	168° C.
70° "	165° "	140° "	168° "
90° "	165° "	150° "	168° "
100° "	173° "	160° "	172° "
120° "	165° "	170° "	176° "

This was received and has been stored in a tin case.

EMMENSITE NO. 5.

Initial temp.	*Firing point.*	*Initial temp.*	*Firing point.*
70° C.	205° C.	150° C.	210° C.
100° "	210° "	180° "	217° "
115° "	215° "	190° "	209° "
130° "	217° "	200° "	217° "

This was received and stored like No. 2.

THE MANUFACTURE OF COMMERCIAL HYDROGEN DIOXIDE AND ITS APPLICATIONS.

By A. Bourgougnon.

Since Bloxam, in the last edition of his "*Chemistry, Inorganic and Organic,*" (*London, 1888, p. 55*), makes the following statement: "This compound (H_2O_2) . . . . . has no very important useful application in the arts." I have deemed it wise to state what has been and is now done in this country with this article. Bloxam's remark is perfectly true as far as pure hydrogen dioxide is concerned, but is, nevertheless, misleading. Solutions of hydrogen dioxide are now manufactured in a commercial way and chiefly applied to bleaching purposes.

My first experiments in manufacturing hydrogen dioxide were conducted in 1873 under very unfavorable circumstances; the barium dioxide which could be obtained in this city was of a very inferior quality and quoted as high as $1.50 per ounce. I followed the method of preparation described by Thenard in 1818, and all I could produce was employed by hair dealers in their trade.

In 1878 I manufactured hydrogen dioxide on a commercial scale, and the following is a description of the method I adopted for the preparation of this bleaching compound:

The first step, and a very important one, is the hydration of the barium dioxide.

Into a suitable vessel, an ordinary cylindrical stone pot, about half full of water, the powdered dioxide is slowly poured, the mix-

ture being well stirred with a wooden spatula during this operation, and continued after its completion for about twenty minutes. Then the mixture is left alone and stirred every half hour, or oftener, for about ten minutes, until the hydration is completed. This operation requires from three to four hours; the barium dioxide forms then a thick, perfectly white and smooth, pasty mass resembling white clay mixed with water.

While the hydration is progressing a mixture of water and hydrofluoric acid is made in a vessel lined with sheet lead and surrounded with ice or simply with water in which lumps of ice are placed from time to time so as not to allow the acid mixture to rise above 10° C. during the operation.

All things being properly disposed, the hydrated barium dioxide is added in portions of three to four pounds at a time to the acid mixture, stirring all the time to mix the contents of the vessel thoroughly. All the barium is transferred to the acidulated water in about two hours and the agitation continued for four hours. If the operation has been well conducted, all the barium dioxide is transformed into fluoride, which falls to the bottom of the vessel. When this precipitate is well settled, the supernatant liquid is decanted into a vessel similar to the one used for its production, and also surrounded by ice water. The clear liquid contains an excess of acid and impurities derived from the materials employed, its color is yellowish and it must be purified to insure its keeping properties.

The impurities which are to be removed are chiefly ferric oxide, alumina and manganese oxide. To the cold solution of impure hydrogen dioxide small quantities of hydrated barium dioxide are added at a time and well stirred. When the last traces of acid are saturated, the appearance of the liquid suddenly changes, from a bright yellow it turns to a greyish color, the impurities are separated and collect at the surface of the liquid.

Without losing time the liquid is filtered through a cheese cloth stretched on a frame, and received in a vessel which contains a small quantity of sulphuric acid diluted with eight to ten times its volume of water (acid, one ounce; water, 8–10 ounces). This filtration must be quickly done. As long as the solution is alkaline

there is great danger of decomposition and loss of oxygen. If the liquid is thrown upon the filter, the latter will be quickly clogged, the filtration stopped, and the hydrogen dioxide will rapidly decompose, emitting large bubbles of oxygen with a hissing noise, but as the precipitated impurities collect first on the top of the liquid, the solution is syphoned from below these impurities, the liquid filters quickly and satisfactorily. The filtered liquid is tested for barium, and sulphuric acid is added to it until all is removed. The liquid is left over night, the precipitate of barium sulphate settles and the perfectly clear and colorless liquid is ready for the market.

All the precipitates are separated, by pressure, from the liquid they may contain, and the liquid so obtained is added to the water employed in the next operation.

I employed the following proportions:

Barium dioxide	60 pounds
Hydrofluoric acid	25 pounds
Water	40 gallons

and obtained nearly forty gallons of hydrogen dioxide. The strength of the acid was about 33 per cent.

Commercial hydrogen dioxide can be produced at the following figures:

60 lbs. Barium dioxide @ 25c.	$15 00
25 lbs. Hydrofluoric acid @ 18c.	4 50
Ice	50
	$20 00

or fifty cents per gallon for the materials used in the manufacture. The price of 18 cents per pound for hydrofluoric acid is high.

Other methods could be employed for manufacturing hydrogen dioxide. Before adopting hydrofluoric acid I used oxalic acid, but this is not to be recommended, not only on account of the price, but because some acid may be left in the solution.

The method recommended by Thomsen consists in dissolving the barium dioxide in dilute nitric acid and when nearly all the acid is saturated, an excess of baryta water is added, hydrated barium dioxide is thrown down, is separated, washed and agitated with water containing one-third of its weight of sulphuric acid. In

this process, part of the barium can be recovered; during the treatment of the dioxide with hydrated nitric acid, a large amount of barium nitrate is separated from the liquid and this salt may be easily reconverted into barium dioxide. A stream of carbon dioxide conducted into water in which barium dioxide is added produces hydrogen dioxide, but the solution thus obtained, although very pure, is too weak for industrial applications.

The commercial solutions of hydrogen dioxide are said to contain about fifteen times their volume or useful or active oxygen. The test is made by adding to the solution sulphuric acid and potassium permanganate and measuring the volume of oxygen evolved. This method is incorrect (see my paper, this journal, June, 1889). A small amount of oxalic acid would greatly increase the volume of gas liberated.

The first application of hydrogen dioxide on a large scale in the United States was due to the experiments made in 1878 by Prof. R. Ogden Doremus in the bleaching of ostrich feathers. The process was kept secret for about a year and a half, after which it came into general use, and the manufacture of hydrogen dioxide then developed rapidly to its present extensive proportions.

Ostrich feathers are imported in bunches and are very dirty. They are strung and well washed with soap and warm water; they are afterwards rinsed until the wash water is clear and then partially dried. For the soap generally used I have substituted sodium silicate with very good results and a great saving of labor. When the feathers are clean they are immersed in the bleaching solution rendered alkaline with a slight excess of ammonia and abandoned to the action of nascent oxygen for about twelve hours, then well washed with soap or sodium silicate and warm water and rinsed, the last water containing starch, and they are beaten until dried. If one bath is not sufficient the operation is repeated. The feathers become *white*. Hair in commercial transactions is known as "human" and "Chinese." Chinese hair is bleached more extensively than human, because it is cheaper and its strength allows it to be submitted to such treatment without being too much injured. For bleaching human hair the same process is employed as for fea-

thers. For Chinese hair the first step is to render it thinner; this is done by immersions in a solution of alkaline hypochlorites, or a solution of potassium chlorate and hydrochloric acid. When the hair is "refined" it is treated like human hair; but to obtain a perfect bleaching several baths are required, sometimes as many as twelve to fifteen, and yet the white is not pure; it retains a yellowish hue which does not entirely disappear by bluing.

The very white and silky looking hair which is seen in the stores is not human; it is obtained from the yak (*Poephagus grunniens*, Linn), an animal native to the mountains of Thibet. Hydrogen dioxide is also employed to change the color of dark hair to a lighter shade. Two or three applications make the hair turn red; if continued longer a light blonde is obtained.

It might happen that some persons would have recourse to these means to conceal their identity, but it will be very easy to discover if the hair has been discolored. After about a week the newly grown hair will be darker near the roots than in their other parts.

Several other materials are bleached with hydrogen dioxide, among them wood, ivory, whalebone, silk, etc.

Tusah or wild silk is very easily bleached. It is first boiled with soap water, rinsed and transferred to the bleaching bath. I have found that a solution of hydrogen dioxide, prepared in a very rudimentary way, is all that is necessary to bleach this kind of silk.

The hydrated barium dioxide is simply dissolved in dilute hydrochloric acid, and, without removing the impurities or the barium, the solution is ready to be employed after being made alkaline with ammonia. When the silk is removed from the bath it is well washed, and to the last rinsing some hydrochloric acid is added.

When hydrogen dioxide was discovered in 1818 by Thenard, it was thought that this new compound could be advantageously employed as a medicine. Experiments carefully conducted in England failed to sustain this claim, but, nevertheless, if hydrogen dioxide is worthless as a medicine, it is a powerful antiseptic. In September, 1888, I had the opportunity of witnessing this im-

portant property. A lady suffering from cancer had had one breast amputated; at the suggestion of Prof. R. O. Doremus, hydrogen dioxide was selected as an antiseptic and the results were very favorable, the wound healed quickly without suppuration. In such cases, pure solutions must be employed; the commercial product contains free acids and when vaporized in a room produces irritation of the throat and coughing.

In conclusion, I will state that I do not believe that the manufacture of commercial hydrogen dioxide is susceptible of much development. Its chief application, the bleaching of ostrich and fancy feathers, is controlled by fashion; its use for changing the color of live hair is rapidly decreasing, henna (*Lawsonia Inermis*) which is less objectionable being a substitute. The high price of production forbids its application for the bleaching of comparatively low priced products, and unless new applications are found and the price of manufacturing greatly reduced, the demand for hydrogen dioxide cannot be increased.

Nevertheless, the preparation of hydrogen dioxide, on a comparatively large scale, is carried out in New York by the introduction of several improvements whereby as much as two hundred gallons are obtained in one operation; the stirring of the working vats is done by steam power, and the qualities of the product, which are always uniform, are highly commended and appreciated by the trade.

GENERAL CHEMISTRY.

On the Presence of Nitrous Acid in the Atmosphere. L. T. Losway.

In his experiments the author finds some form of combined nitrogen constantly present upon the surface of grass, leaves and branches. In clear and dry weather ammonium nitrite is converted into nitrate, either by the oxygen from the leaves or by atmospheric oxygen under the influence of sunlight. He has also found nitrous acid in the water of soils of different kinds after washing

and calcining, and then wetting with pure water. The presence of nitric acid can also be detected after destruction of the nitrous acid, but ammonia was found only in minute traces. The same soils placed in a tube and put in contact with *pure* air did not show any of the nitrogen compound substances above mentioned, even after ten days exposure. But if into the same tubes *ordinary* air was passed for twenty-six hours, the presence of nitrous acid was easily shown. (*Bull. Soc. Chim.*, [3], **2**, *666.*) M. L.

Distinction of Phosphorus Oxychloride from Trichloride. G. DENIGES.

The process is based upon the action, observed by the author, of phosphorus oxychloride on an excess of zinc powder. Flame is produced with white fumes of phosphoric anhydride. Zinc phosphide is also formed, as indicated by the production of spontaneously inflamable phosphorus hydride on addition of water to the mass.

With the trichloride there is no such action. (*Bull. Soc. Chim.*, [3], **2**, *787.*) M. L.

On an Acid Cerium Sulphate. G. WYROUBOFF.

According to the opinion of the author the question of the atomicity and atomic weight of cerium is far from settled. Mendelejeff, guided by theoretical considerations relating to the periodicity of atomic weights proposed to change the old formulæ of cerium oxides, CeO and Ce_3O_4, into Ce_2O_3 and CeO_2, the atomic weight being then 141.6 instead of 94.4, the former being in accordance with the atomic heat 6.34.

Notwithstanding this apparent accordance, the author supposes that cerium may be an exception to Dulong and Petit's law. The chemical and physical properties of the salts of cerium seem to justify the first hypothesis of the formulæ CeO and Ce_3O_4. By crystallizations of the sulphate of the lower oxide, the author has obtained the body $CeSO_4$. SO_4H_2 with Ce = 94, a sulphate having many similarities with the sulphates of the magnesian series, being one more acid sulphate of a monoxide. If the formula were written $(SO_3)3Ce_2O_3$. $3SO_4H_2$ with Ce = 141.6, this body would be the absolutely unique exception of an acid salt of a sesquioxide. (*Bull. Soc. Chim.*, [*3*], **2**, *745.*) M. L.

Action of Water on Stannic Chloride. LEO VIGNON.

An aqueous solution of stannic chloride must be considered as a mixture of water, hydrochloric and stannic oxide. From calometric experiments and considerations the author concludes that the chemical state of an aqueous solution of stannic chloride is unstable, and that the modification leads towards a state of equilibrium varying with dilution and temperature. The presence of HCl retards and limits the polymerisation of the stannic oxide; NaCl and KCl do the same; this is illustrated in the use of the so called pink salt (stannic chloride and KCl) in the arts. (*Bul. Soc. Chem.*, [3], **2**, *593.*) M. L.

Notes on Mellitose. M. BERTHELOT.

This sugar was discovered by the author in 1886; rediscovered in molasses by M. Loiseau and called by him *raffinose;* found in cotton seed cake by Ritthausen, and studied by Scheibler and Tollens. The sugar obtained by Loiseau and others occurs in small crystals, containing 15.1% of water of crystallization; it corresponds to the formula

$$C_{36}\,H_{32}\,O_{32}+5H_2\,O_2.*$$

The rotary power of the solution of this hydrate is the same as that of raffinose.

Under the influence of a weak yeast ferment, only one-third of this sugar is converted, even after two weeks, although cane sugar and glucose would be entirely transformed in forty-eight hours. The probability is that this sugar breaks up into a glucose, which ferments and disappears, and a second sugar of the saccharose family able to produce a certain reduction (of Fehling solution) or a mixture of two glucoses, of which one only has reducing action. (*Bull. Soc. Chim.*, [3], **2**, *655.*) M. L.

On a Nitro-Phenol: Campho-Nitrophenol, Isomeric with Nitro-Camphor. P. CAZENEUVE.

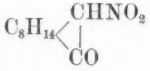
When the α-nitro-camphor or the nitro-camphor, hydrochloride of the body studied by the author ([3], **1**, 243) are boiled with conc. hydrochloric acid, there is obtained a neutral body, isomeric

* The author has obtained another hydrate answering to $C_{36}\,H_{32}\,O_{32}+6H_2\,O_2$.

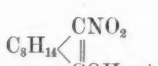
with nitro-camphor, not possessed of the acetone function, but of the tertiary or phenol function. The preparation and composition of this body are given. The formula is

$$C_{10}\,H_{15}\,(NO_2)\,O\,H_2\,O.$$

It is more soluble in water than camphoric acid, soluble in all proportions in boiling water, soluble in alcohol, ether, chloroform and benzol. The author gives the crystallographic description of the crystals obtained, in dilute alcohol. In this paper, too long to be condensed, the author establishes the nature of this body. If nitro-camphor is



The new body is



(*Bull. Soc. Chim.*, [3], **1**, *417.*) M. L.

Fixation of Atmospheric Nitrogen by Plants. M. BERTHELOT.

The author remarks that the belief that free nitrogen of the air takes no active part in vegetable growth is seemingly abandoned, and that this change of view has been brought about by his researches, which have shown that fixation of nitrogen is produced by the action of some kind of microbes. He cites in corroboration the experiments of G. Ville, Hellriegel and Willfarth, as to the relation of leguminous plants to this question, and those of Dehérain Julie Breal on the fixation of nitrogen by argillaceous soils. The experiments of the author have been fully confirmed by Frank of Berlin, and by Pichard and Tacke. (*Bull. Soc. Chim.*, [*3*], **2**, *652.*) M. L.

Volumetric Determination of Sulphates. H. QUANTIN.

The process is based on the insolubility of barium chromate in ammonia, and on the decomposition of a chromate by a sulphate (chromic acid being set free, and combining with the alkali of the sulphate); subsequent separation of the decomposed barium chromate by ammonia, and determination of the chromic acid by a ferrous solution, using potassium ferricyanide as an indicator. The

solutions employed are, 19.48 grms. potassium chromate in 200 c.c. water, 50–100 c.c. HCl; 24.35 grms. $BaCl_2.2H_2O$ made up to 1 litre and filtered. The solution must contain a slight excess of chromate, which must be kept account of and deducted. Indications, *modus operandi*, and examples of the accuracy of the process are given. (*Bull. Soc. Chim.*, [3], **1**, *21.*) M. L.

Technical Analysis of Water. Leo Vignon.

The author, following the suggestion of Dr. A. Rossel of Winterthür, as to the exclusive use of sodium carbonate for the purification of waters for steam boilers, proposes a method of analysis having for its purpose to find what quantity of reagent is necessary to decompose the chlorides and sulphates of calcium and magnesium, the quantity of alkali answering to the bicarbonates having been determined once for all. This latter is calculated by the formula.

$$\frac{V \times Cv \times CO_3Na_2}{CO_2} \times 1.9774 \text{ or } V \times Cv \times 4?6 \text{grms.}$$

V, being the average quantity of water of the boiler in normal run.

V′, the average quantity of water evaporated.

Cv, the volume of CO_2 (in litres) for 1 cubic metre of water.

P, the quantity of Na_2CO_3 answering to sulphates and chlorides.

P V′, the quantity of reagent to be used daily.

The process is volumetric and takes: 1st, a solution of calcium hydrate; 1gr.80 per litre; 2d, alcoholic phenolphthaleine; 3d, a solution of $CaCl_2$, 5 per cent. strong; Na_2CO_3 1 grm. per litre, etc. (*Bul. Soc. Chim.*, [3], **2**, *596.*) M. L.

Detection of Free Chlorine in HCl. G. A. LeRoy.

Very small traces of Cl can be detected by addition of a few crystals of diphenylamine to the acid. (*Bul. Soc. Chim.*, [3], **2**, *789.*) M. L.

ABSTRACTS.

Abstracts of American Patents Relating to Chemistry.

(*From the U. S. Patent Office Gazette.*)

Issued February 25th, 1890.

421,904.—Process of bleaching wax. W. Bruening.

The wax is atomized by a jet of steam or air, and the resulting powder bleached by the action of light, air and moisture.

421,935.—Process of making alkaline salts of antimony. J. Holliday.

The alkaline antimonites, generally considered antimonoso-antimonates, are prepared by treating metallic antimony in hot solutions of an alkaline nitrate or nitrite and caustic alkali.

422,018.—Blue-green dye. A. Herrmann.

Derivative of metaoxytetralkyldiamidotriphenylmethane.

422,118.—Process of carburizing malleable cast iron or low carbon steel. M. F. Coomes and A. W. Hyde.

The metal, raised to a white heat, is placed in a bath composed of water or milk and a carbohydrate.

422,119.—Process of carburizing malleable cast iron or low carbon steel. M. F. Coomes and A. W. Hyde.

The metal, raised to a white heat, is immersed in milk.

422,120.—Process of carburizing malleable cast iron or low carbon steel. M. F. Coomes and A. W. Hyde.

The metal, raised to a white heat, is placed into a bath containing an organic acid, which results from the oxidation of glycogen.

422,121.—Process of carburizing malleable cast iron or low carbon steel. M. F. Coomes and A. W. Hyde.

The metal, raised to a white heat, is placed into a bath formed by adding to water or milk a mixture of a carbohydrate and an oxidizing agent.

422,128.—Furniture polish. J. M. Hall, C. Morris and W. S. Hamilton.

Consists of Japan drier, linseed oil, turpentine, copal varnish, alcohol, hydrochloric acid and olive oil.

422,140.—Process of recovering alkali and glycerine from spent soap lye. E. D. Mellen.

The soap is precipitated from the soap stock by an excess of aqueous

solution of alkali, whereby the resulting lye is obtained free from salt, after which the lye is concentrated and saturated with carbon dioxide, which separates the alkali as bicarbonate and leaves the glycerin in solution.

422,141.—Aparatus for making soap and carbonic acid. E. D. Mellen.

422,173.—Gas washer. F. A. M. Alavoine.

422,195.—Varnish. W. D. Field.

A non-hygroscopic varnish or lacquer for use on metals and hard or non-absorptive surfaces, consisting of a concentrated solution of shellac, in combination with a solution of pyroxylin in a practically non-hygroscopic menstrum miscible with the shellac solution.

422,234.—Condenser with multiple effect evaporator. S. M. Lillie.

422,235.—Evaporating apparatus. S. M. Lillie.

422,322.—Carburetor. J. W. Strouse and A. B. Strouse.

422,334.—Hydrazin. T. Curtius.

422,357.—Filter. F. T. Weidan and W. E. Kane.

Issued March 4th, 1890.

422,369.—Drum for fluid-separating machines. W. Bergh.

422,403.—Process of making steel containing carbon, manganese and aluminium. R. A. Hadfield.

422,430.—Printing ink. J. McCloskey and C. F. Farwell.

An ink for printing upon celluloid, consisting of pigment, albumin (animal or vegetable) and glycerin.

422,464.—Baking powder. H. D. Thatcher.

Consists of cream of tartar, an alkaline bicarbonate, and sugar of milk.

422,484.—Adjustable filtering and percolating stand. A. P. Yarnall.

422,500.—Process of purifying aluminium chloride. H. Y. Castner.

Iron is removed from aluminium chloride by melting the crude chloride and treating it electrolytically.

422,509.—Process of obtaining chromium and chromium alloys. A. K. Eaton.

Consists in first producing a chromite of the desired metal, and then reducing the chromite to an alloy.

422,514.—Manufacture of explosives. S. H. Emmens.

Consists in fusing a suitable hydrocarbon substition derivative, such as trinitrophenol, adding a suitable nitrate, continuing a sufficient degree of heat until actual liquefaction of the mixture is attained, and then allowing the same to cool.

422,515.—Manufacture of explosives. S. H. Emmens.

422,692.—Apparatus for the manufacture of gas. J. D. Averell.

422,750.—Polishing powder. E. P. Eells.
Consists of callustro, ammonium carbonate, and sodium carbonate.

422,806.—Apparatus for distilling wood. O. Koch.

Issued March 11th, 1890.

422,907.—Artificial fuel. J. Bowing.
Coal and coke dust, breeze, and similar substances are agitated with tar or pitch, in or under water, and allowed to settle. The water is then drawn off, and the mixture formed into blocks or briquettes, and dried.

422,939.—Method of separating impurities from salt. T. Higgin.

423,011.—Hydrocarbon burner. J. Wilson and A. Mason.

423,012.—Process of burning petroleum or other hydrocarbons. J. Wilson and A. Mason.

Consists in injecting oil, steam and air into a highly heated retort, and discharging the resultant products at the burning point.

423,042.—Waterproof composition for roofing, etc. A. M. Ford.
Consists of steam, pitch, oil, soap and petroleum.

423,044.—Apparatus for the manufacture of oil gas. W. B. Frink.

423,047.—Paint. W. B. Grover.
Consists of rubber pulp dissolved in dead oil of coal tar, a drier, a varnish, a mineral coloring matter, and the distilled unbroken residuum of bituminous gas coal tar.

423,071.—Production of restored or devulcanized rubber. N. C. Mitchell.
Consists in devulcanizing the rubber by the action of live steam, then while the rubber is yet moist rolling it until reduced to a powder, and finally drying the powder, and at the same time agitating or keeping it in motion to preserve the powdery condition.

423,101.—Process of electroplating non-metallic articles. W. H. Winslow.

423,127.—Apparatus for making infusions. J. Childs.

423,131.—Hydrocarbon injector burner. C. Cole.

423,133.—Cooling and refrigerating apparatus. H. J. W. S. Cooke.

423,183.—Weighing scales. J. G. Schmidt.

423,213.—Obtaining peptone and maltose. A. Brunn.
Albuminous and starchy substances are converted into peptone and maltose by fermentation, after which the peptone and maltose are separated by lixiviation with water.

423,230.—Explosive. S. H. Emmens.
Consists of paper or paper stock converted into a nitrocompound and impregnated with ammonia and picric acid.

423,257.—Carburetor. L. C. Huber.

423,263.—Making malted bread. J. Montgomerie.

Consists in first mixing flour, water and extract of malt or maltine, heating the mixture in a water bath to 130°–150° F., with agitation, maintaining it at that temperature for a few hours until the diastase acts on the starch and converts it into soluble dextrin and sugar, then making a dough of this compound by further addition of flour, and subsequently forming and baking the same.

423,281.—Alloy. W. V. Shelton.

Composed of copper, zinc, nickel, iron, manganese and silicon.

423,306.—Apparatus for the manufacture of ice. J. W. Brook.

423,320.—Process of making phosphatic fertilizers. E. R. Hodgkins.

Consists in combining finely pulverized phosphatic material and calcic oxide, slaking the calcic oxide by the addition of water, and finally intimately mixing the ingredients.

423,341.—Green dye. A. F. Poirrier.

Green or greenish coloring matters are produced by condensing with tetramethyldiamidobenzhydrol, in a hydrochloric or sulphuric acid medium, paratoluidine, a metaxylidine, pseudocumidine, amidotrimethylbenzol, or mesidine, and subjecting the leuco bases thus formed to oxidation, or oxidation in conjunction with the formation of hydroxyl, methyl, ethyl, benzyl and sulpho-conjugated benzyl derivatives of said leuco bases.

423,347.—Apparatus for generating and burning gaseous fuel in furnaces. E. P. Shetter. W. R.